TWO NEW SPECIES OF PARASITIC NEMATODES.

By Brayton Howard Ransom,

Assistant Custodian, Helminthological Collections, United States National Museum.

Since Looss (1905) established the genus *Trichostrongylus* to include the species *T. retortæformis* (type), *T. instabilis*, *T. vitrinus*, and *T. probolurus*, several other species have been added from time to time by various authors. Including the two species described in the present paper, the complete list, with hosts and geographic distribution, is as follows:

T. retortæformis (Zeder, 1800) Looss, 1905; rabbits; Europe.

T. instabilis (Railliet, 1893) Looss, 1905; man, baboon, ruminants; Africa, Europe, Japan, United States, (?) India. (This and the next following species are perhaps identical.)

T. colubriformis (Giles, 1892) Ransom, 1911; sheep; India.

T. vitrinus Looss, 1905; man, ruminants; Europe, Africa, United States.

T. probolurus (Railliet, 1896) Looss, 1905; man, ruminants; Africa, Europe, United States.

T. extenuatus (Railliet, 1898) Ransom, 1907; ruminants; Europe, United States, Australia.

T. capricola Ransom, 1907; ruminants; United States.

T. axei (Cobbold, 1879) Railliet and Henry, 1909; horse, ass; Europe.

T. falculatus Ransom, 1911; goat; Portuguese East Africa.

T. calcaratus Ransom, 1911; rabbit; United States.

T. pergracilis (Cobbold, 1873) Shipley, 1908; grouse; Europe.

T. tenuis (Eberth, 1861) Railliet and Henry, 1909; geese; Europe.

Strongylus quadriradiatus Stevenson, 1904, and *Strongylus nodularis* Rudolphi, 1809, which Shipley (1909) has placed in *Trichostrongylus*, are widely different from the type and should be excluded from this genus.

Family STRONGYLIDÆ Cobbold, 1864.

Subfamily TRICHOSTRONGYLINÆ Leiper, 1908.

Genus TRICHOSTRONGYLUS Looss, 1905.

For generic diagnosis, see Looss (1905) or Ransom (1911, p. 86).

TRICHOSTRONGYLUS FALCULATUS, new species.

Specific diagnosis.—Trichostrongylus: Male 4.6 mm. long by 80 μ in maximum thickness (at base of bursa). Latero-ventral (*l. v.*, fig. 1) and externo-lateral rays (*e. l.*, fig. 1) of bursa about equal in width, wider than any of the other rays. Medio-lateral ray (*m. l.*, fig. 1) about two-thirds the width of the latero-ventral or the externo-lateral ray. Postero-lateral ray (*p. l.*, fig. 1) slightly narrower than the medio-lateral ray, curves dorsally in its distal portion away from the latter. Externo-dorsal (*e. d.*, fig. 1) and ventro-ventral (*v. v.*, fig. 1) rays narrower than any of the other paired rays. Ventro-ventral ray straight. Externo-dorsal ray curved dorsally in its distal portion, its tip a considerable distance from the middle of the dorsal ray, but nearer to the latter than to the tip of the postero-lateral ray. Dorsal ray (*d. r.*, fig. 1) bifurcated distally, each branch having a bipartite tip. Spicules (fig. 2) similar in shape and size, 100 μ long, brown in color. An angular projection from the ventral side of each spicule about 60 μ from the anterior end. The terminal portion thus marked off tapers gradually to a point, and is slightly curved ventralward, so that it forms a falciform process 40 μ long. Gubernaculum (fig. 2) similar in color to the spicules, bent almost at a right angle, with the convexity dorsal; distance between the anterior and posterior ends, 50 μ.

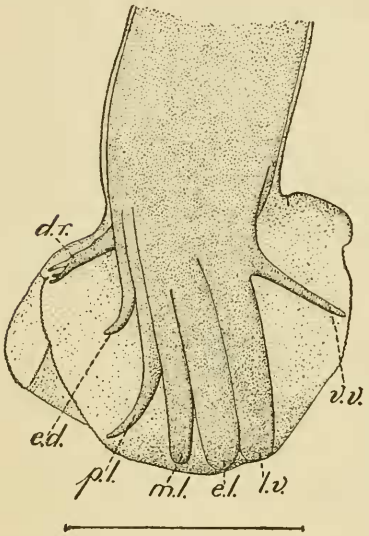

FIG. 1.—TRICHOSTRONGYLUS FALCULATUS. BURSA OF MALE VIEWED FROM RIGHT SIDE. *d.r.*, DORSAL RAY; *e. d.*, EXTERNO-DORSAL RAY; *e. l.*, EXTERNO-LATERAL RAY; *l. v.*, LATERO-VENTRAL RAY; *m. l.*, MEDIO-LATERAL RAY; *p. l.*, POSTERO-LATERAL RAY; *v. v.*, VENTRO-VENTRAL RAY.

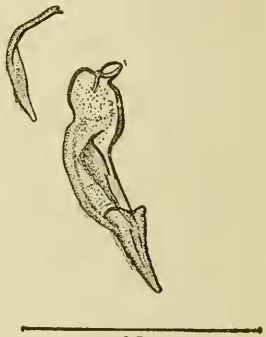

FIG. 2.—TRICHOSTRONGYLUS FALCULATUS. SPICULE AND GUBERNACULUM VIEWED FROM RIGHT SIDE.

Female.—Unknown.

Host.—Goat (*Capra hircus*).

Location.—Alimentary tract.

Locality collected.—Pesene, South Africa.

Type-specimens.—Bureau of Animal Industry Helminthological collection, Cat. No. 15980, U.S.N.M., collected August 9, 1908, by C. W. Howard.

About a dozen specimens of males of this species were present among some nematodes labeled as collected from a goat which had been sent by Mr. Howard to the Bureau of Animal Industry, United States Department of Agriculture, for identification. A careful search was made for females, but none could be found. The other nematodes were *Trichostrongylus instabilis*, *Oesophagostomum columbianum*, *Hæmonchus contortus*, *Strongyloides papillosus*, *Gaigeria pachyscelis*, and *Bunostomum trigonocephalum*.

The other known species of *Trichostrongylus* occurring in ruminants are *T. colubriformis*, *T. instabilis* (possibly identical with the preceding), *T. vitrinus*, *T. probolurus*, *T. extenuatus*, and *T. capricola*. *T. falculatus* is readily distinguished from all of these except *T. extenuatus* by the small size of the spicules, *T. falculatus* and *T. extenuatus* being the only species having spicules less than 125 μ in length. Apart from differences which they present in the shape of the spicules, these two species are distinctly different however in that the spicules of *T. falculatus* are equal in size; whereas the spicules of *T. extenuatus* are unequal, the left spicule being considerably longer than the right. The shape of the gubernaculum of *T. falculatus* is another feature marking this species, as none of the other species has a gubernaculum bent in the same manner.

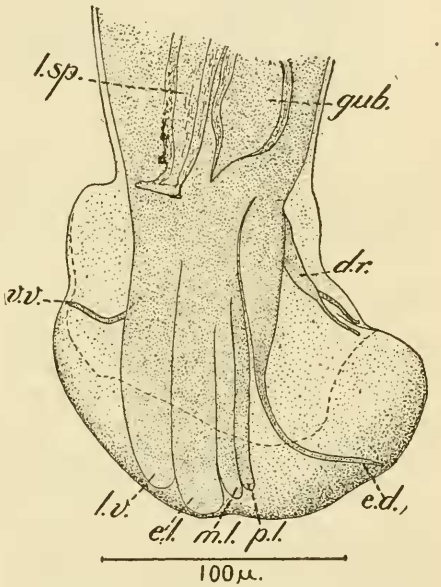

FIG. 3.—TRICHOSTRONGYLUS CALCARATUS. BURSA OF MALE VIEWED FROM LEFT SIDE. *d. r.*, DORSAL RAY; *e. d.*, EXTERNO-DORSAL RAY; *e. l.*, EXTERNO-LATERAL RAY; *gub.*, PORTION OF GUBERNACULUM; *l. sp.*, PORTION OF LEFT SPICULE; *l. v.*, LATERO-VENTRAL RAY; *m. l.*, MEDIO-LATERAL RAY; *p. l.*, POSTERO-LATERAL RAY; *v. v.*, VENTRO-VENTRAL RAY.

TRICHOSTRONGYLUS CALCARATUS, new species.

Specific diagnosis.—*Trichostrongylus: Male*, 4.7 to 6.6 mm. long. Maximum thickness 100 to 130 μ (at base of bursa). Lateral lobes of

bursa, in preserved specimens, tightly curled inward so that it is impossible to spread the bursa out flat. Latero-ventral (*l. v.*, fig. 3) and externo-lateral (*e. l.*, fig. 3) rays closely approximated to one another, about equal in thickness, the former slightly the thicker, each much thicker than the other rays. Externo-dorsal ray (*e. d.*, figs.3, 4) long, curving dorsalward in its distal portion; proximally it is thick, distally very slender. Ventro-ventral ray (*v. v.*, fig. 3) slender, of about the same thickness as the distal portion of the externo-dorsal ray. Postero-lateral (*p. l.*, figs. 3, 4) and medio-lateral (*m. l.*, fig. 3) rays of about equal thickness, the latter slightly the thicker, less than half as thick as the externo-lateral ray, closely approximated except at their tips, where they diverge slightly, the postero-lateral ray dorsalward and the medio-lateral ray ventralward. Medio-lateral ray closely approximated to the latero-ventral ray. Dorsal ray (*d. r.*, figs. 3, 4) unites at its base with the base of the right externo-dorsal ray; bifurcated distally. The dorsal lobe of the bursa is not distinct from the lateral lobes, and is deeply emarginate between the distal branches of the dorsal ray (fig. 4). Distal branches of the dorsal ray are very slender, with simple unbranched tips. Spicules (fig. 5) 175 to 190 μ long, nearly equal in length but somewhat different in shape, dark brown in color, slightly curved ventralward with truncate tips and without the ventral angular projection typical of *Trichostrongylus*. Tip of left spicule with a large beaklike process or spur projecting ventrally, and a small

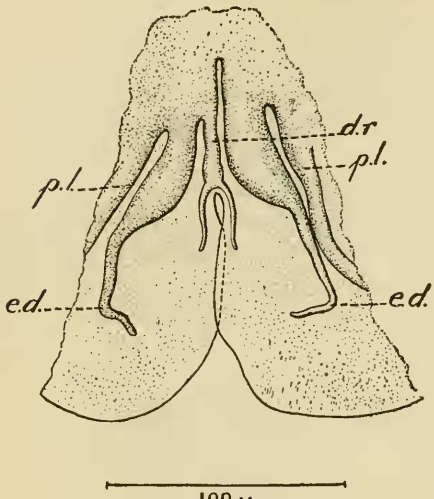

FIG. 4.—TRICHOSTRONGYLUS CALCARATUS. PORTION OF BURSA SHOWING ORIGIN OF DORSAL RAY. *d. r.*, DORSAL RAY; *e. d.*, EXTERNO-DORSAL RAY; *p. l.*, PORTION OF POSTERO-LATERAL RAY.

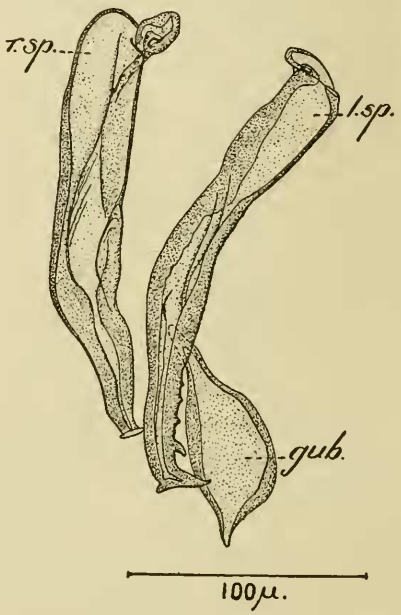

FIG. 5.—TRICHOSTRONGYLUS CALCARATUS. SPICULES AND GUBERNACULUM. *gub.*, GUBERNACULUM; *l. sp.*, LEFT SPICULE; *r. sp.*, RIGHT SPICULE.

spur projecting dorsally. Anterior of the ventral beak a small hook, and in front of the latter a series of two or three small projections, the ventral surface of the distal portion of the spicules for a distance of about 50 μ, thus having a hooked, barbed, and roughened appearance. The ventral surface of the right spicule is smooth. Tip of the right spicule smaller than that of the left, with a small flattened caplike enlargement projecting dorsally and ventrally as very small pointed processes, and laterally as a very small ridge. Gubernaculum (fig. 5) about 100 $\mu \times 35$ μ in length and breadth respectively, similar in color to the spicules, with an oval body and a short pointed process posteriorly and a longer process anteriorly.

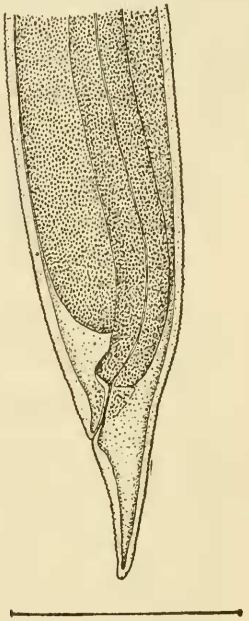

FIG. 6.—TRICHOSTRONGYLUS CALCARATUS. POSTERIOR END OF BODY OF FEMALE VIEWED FROM LEFT SIDE.

Female, 5.8 to 7 mm. long by 90 to 120 μ in diameter at the vulva. Anus 65 to 90 μ from the tip of the tail. Posterior end of the body (fig. 6) is commonly rather abruptly though slightly diminished in size a short distance in front of the anus, then tapers gradually to the tip of the tail, or beginning some distance in front of the anus may taper gradually to the tip. Tail straight.

FIG. 7.—TRICHOSTRONGYLUS CALCARATUS. REGION OF VULVA OF FEMALE VIEWED FROM RIGHT SIDE.

Vulva (fig. 7) 850 μ to 1 mm. from the tip of the tail, elongated diagonally, 50 to 60 μ long with inconspicuous lips. Combined length of muscular portions of the ovijectors 450 to 560 μ. Eggs 60 to 70 μ long by 30 to 36 μ wide, in 8 to 32 celled stage when deposited.

Host.—Rabbit (*Lepus sylvaticus*).

Location.—Small intestine.

Locality collected.—Bowie, Maryland.

Type-specimens.—Bureau of Animal Industry Helminthological collection, Cat. No. 15968, U.S.N.M., collected May 31, 1911.

This nematode has been found almost constantly present in wild rabbits in the vicinity of Bowie, Maryland. The only other known species parasitic in rabbits with which it is likely to be confused is *Trichostrongylus retortæformis*, and from this it may readily be distinguished by the wide differences

in the bursa and spicules of the male, and by the size of the eggs and position of the vulva of the female, the eggs of *T. retortæformis* measuring above 75 μ in length, and the vulva being from 1.75 to 2 mm. from the tip of the tail.

It is perhaps questionable whether *T. calcaratus* should be included in the genus *Trichostrongylus* in view of the rather aberrant characters of the dorsal ray of the bursa, and of the spicules. The asymmetrical origin of the dorsal ray and the termination of its branches in undivided tips are atypical, as also is the shape of the distal portion of the spicules. For the present, however, it seems better to look upon this nematode as an aberrant species of *Trichostrongylus* rather than as the single representative of a separate closely related genus.

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